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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/680,895	10/08/2003	Helen Zhu	P1052-LAM (RAO#1)	5978

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EXAMINER

NGUYEN, THANH T

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 08/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/680,895

Applicant(s)

ZHU ET AL.

Examiner

Thanh T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Specification

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

In the specification page 2, line 18, the Serial No. of the related application is missing.

Claim Rejections - 35 USC § 112

Claims 6-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6 recites the limitation "said second hardmask layer" in line 8. There is insufficient antecedent basis for this limitation in the claim. It is suggested to change to "said second intermediate layer".

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu et al. (U.S. Patent No. 6,720,256) in view of Levy (U.S. Patent No. 5,126,231) and Hsue et al. (U.S. Patent No. 6,696,222).

Referring to figures 6a-6e, Wu et al. teaches a method of forming a damascene structure comprising:

- forming an OSG layer (74, called polyimide),
- forming a cap layer or hardmask (76) on the OSG layer,
- forming a photoresist layer (see col. 9, lines 65-67, col. 10, lines 1-2), etching the cap layer and the OSG layer to form a via (77, see figure 6a).

Regarding to claim 2, 7, 18, the photoresist is an organic photoresist. Noted that it is known in the art that photoresist is made of organic material.

Regarding to claim 3, 9, 19, forming a dual damascene (see figure 6d).

Regarding to claim 5, providing a via etched into the IC structure (see figure 6a),

Generating an organic plug (80, called resin) that occupies the via; and

Stripping organic plug (see figure 6d-6e).

Regarding to claim 6, since remove the photoresist without remove the hardmask and the OSG film, therefore it would generating a high selectivity.

Regarding to claim 10, the intermediate layer is a cap layer (called passivation layer, 76).

Regarding to claim 11, cap layer is selected from a group consisting of silicon dioxide (see col. 9, lines 62-67).

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Regarding to claim 12, the second intermediate layer is a hard mask layer (called passivation layer, 76).

Regarding to claim 13, the hardmask layer selected from the group consisting of silicon nitride (see col. 9, lines 62-67).

Regarding to claim 15, generating an organic plug (80) with the via that occupies part of the OSG layer (see figures 6b-6c)

Regarding to claim 16, Etching the trench into the second cap layer and the third OSG layer (see figure 6d).

However, the reference does not teach removing the photoresist layer by using plasma nitrous oxide, stripping the photoresit and etching the OSG film in the same reactor, and etching the trench into the second hardmask layer and apply another the photoresist layer to form a via etch by etching into the OSG layer.

Levy teaches a method of stripping an integrated circuit (IC) structure having a photoresist material and an organosilicate glass (OSG) material comprising:

Feeding a nitrous oxide (N₂O) gas into the reactor (see col. 5, lines 51-64);

Generating a plasma in the reactor (see col. 5, lines 51-64);

Stripping the photoresist (30) by using the nitrous oxide gas (see col. 5, lines 51-64). It is noted that the nitrous oxide gas have to feed in to the plasma reactor to ionize before etching process begin.

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would stripping the photoresist layer by using plasma nitrous oxide in process of Wu et al. as taught by Levy because the process would protect the via,

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eliminate the problem of faceting of the corners of the mask, thereby eliminating the formation of bowed sidewall.

It would have been obvious to etch the photoresist layer because the process would reducing the cycle time and also prevent contamination during transferring from one chamber to another.

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would strip the photoresit and etching the OSG film in the same reactor in process of Wu et al. and Levy because the process would reducing the cycle time and also prevent contamination during transferring from one chamber to another.

Hsue et al. teaches a method of forming a dual damascene process using metal hardmask layer comprising the step of: etching the trench into the second hardmask layer (see figure 2b-2c) and apply another the photoresist layer (44) to form a via etch (45) by etching into the OSG layer (36, see figure 2d-2f).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would etching the trench into the second hardmask layer and apply another the photoresist layer to form a via etch by etching into the OSG layer in process of Wu et al. and Levy as taught by Hsue et al. because the process would reduce RC delay and cross talk, lower production cost and simplify the dual damascene process

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal stroke extending to the left.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN